

REMARKS

Claims 1-7 are pending.

The amendments incorporate claim 3 into claim 1 and cancel claim 3.

Claims 1-2 are rejected under 35 U.S.C. §102(b) as being anticipated by U. S. Patent No. 5,756,414 (Huang) on the ground that Huang discloses a process in which a catalyst comprising zeolite L is regenerated to remove coke, and the regeneration comprises contacting the catalyst absent a halogen-containing compound with ozone at regeneration conditions. This rejection should be withdrawn because Huang does not teach a process comprising contacting the catalyst with ozone at regeneration conditions and absent a halogen-containing compound oxidizable by ozone at the regeneration conditions, the contacting occurring at a temperature of from about 20 to about 250°C.

As currently amended, claim 1 recites a process for regenerating a hydrocarbon conversion catalyst comprising zeolite L, the process comprising contacting the catalyst with ozone at regeneration conditions and absent a halogen-containing compound oxidizable by ozone at the regeneration conditions, the contacting occurring at a temperature of from about 20 to about 250°C. Huang discloses removing coke from a catalyst containing zeolite L by burning it off in two stages with oxygen, and that in addition to using oxygen ozone can also be used for this purpose. See col. 13, lines 20-22. The first stage of the coke burn is carried out between about 400°C and about 500°C, and the second stage of the coke burn is carried out at even higher temperatures between about 500°C and about 550°C. See col. 7, lines 29-30 and 59-62; col. 13, lines 43-45; col. 14, lines 9-11. Since the lowest temperature that Huang teaches for the coke burn is about 400°C, the rejection of claims 1-2 under 35 U.S.C. §102(b) as being anticipated by Huang should be withdrawn.

Claims 1-7 are rejected under 35 U.S.C. §103(a) as being unpatentable over the article by Carlos A. Querini titled "Isobutane/butene alkylation: regeneration of solid acid catalysts" (Querini) in view of U. S. Patent No. 5,330,736 (Wu) on the ground that it would have been obvious to use the zeolite L catalyst disclosed in Wu in the process disclosed in Querini and thereby arrive at Applicant's invention. This rejection should be withdrawn because it would not have been obvious for a person of ordinary skill in the art to combine the teachings of Querini with those of Wu and thereby arrive at a process for regenerating catalyst comprising zeolite L.

that comprises contacting the catalyst with ozone at regeneration conditions and in the absence of a halogen-containing compound that can be oxidized by ozone at the regeneration conditions, in which the contacting occurs at a temperature of from about 20 to about 250°C.

Querini describes preparing and regenerating three zeolite Y catalysts. The starting material for preparing all three catalysts is the same zeolite Y, all three are prepared by ion exchanging the zeolite Y in two steps, and all three contain lanthanum (La). One catalyst, "LCH-Y", is prepared by exchanging zeolite Y with $(NO_3)_3La$, drying and calcining, exchanging with $(NO_3)_3NH_4$, and drying and calcining. The second catalyst, "HCL-Y", is prepared in the same way, except using $(NO_3)_3NH_4$ in the first exchange and $(NO_3)_3La$ in the second exchange. The third catalyst, "LCL-Y", is prepared in the same way, except using $(NO_3)_3La$ in both exchanges. None of the catalysts contain any zeolite L. In Querini's naming system, the letter "L" apparently stands for lanthanum introduction by ion exchange, the letter "H" for hydrogen introduction by ion exchange, and the letter "C" for calcination, with the order of the letters in a name corresponding to the order of the preparation steps. See §2.1. The "HCL-Y" catalyst is used to alkylate isobutane with C₄ linear olefins, becomes deactivated, and is regenerated by contact with a stream containing 1% O₃ at 125°C for 4 hours. See §§2.4 and 3.4. Querini also teaches that some catalysts form more coke and are more stable than others, and that microporous materials such as mordenite and zeolite Y have a particular deactivation mechanism in which both site coverage and pore plugging occur. See §1. Mordenite and zeolite Y are the only two zeolites that Querini teaches. See entire article.

Wu teaches a method of producing zeolite L by adding an amorphous aluminosilicate seeding gel into a precursor reaction mixture, which then crystallizes to form zeolite L. See col. 3, lines 24-26; col. 5, lines 3-5 and 28-49; col. 6, lines 22-48; and claim 1. Wu's objectives are to improve nucleation and crystallization rates of zeolite L, to synthesize zeolite L at relatively low temperature and ambient pressure, to use energy efficiently while making zeolite L, and to make a highly pure zeolite L especially free of zeolite T. See col. 1, lines 6-24; col. 5, lines 9-17, 23-27, 49-52, and 54-55; and col. 7, lines 8-13, 40-41, and 61-63. The seeding gel does not contain zeolite L, is not even crystalline, and does not by itself form zeolite L. See col. 5, lines 44-45 and col. 8, lines 27-28. Wu teaches that if the seeding gel were heated to 100°C it would form zeolite Y, and apparently for that reason the seeding gel is prepared and kept below 20°C until it is needed. See col. 5, lines 45-46; col. 6, lines 25-41; and col. 8, lines 1-29. The reaction

mixture is prepared separately from the seeding gel, the seeding gel is added to the reaction mixture, and after seeding the reaction mixture crystallizes to form zeolite L. See col. 5, lines 46-49; col. 6, line 49 to col. 7, line 32; col. 8, lines 55-66 (Example 2, Part B); col. 9, lines 23-41 (Example 3, Part B); col. 9, line 50 to col. 10, line 52 (Example 4); col. 11, line 53 to col. 12, line 21 (Examples 5-8); and claim 1. Finally, Wu teaches that zeolite L can be used as a sorbent or as a catalyst, for example in hydrocarbon conversion processes such as cracking, reforming, isomerization, aromatization, alkylation, or hydrocracking. See col. 7, lines 42-47.

Querini in combination with Wu does not render claim 1 obvious to a person of ordinary skill in the art for the following six reasons.

First, Querini does not even mention zeolite L, and the only zeolite besides zeolite Y that Querini teaches is mordenite. Wu, on the other hand, teaches away from zeolite Y, specifically by keeping the temperature of the seeding gel below 20°C in order to avoid formation of zeolite Y. The only other zeolite that Wu mentions is zeolite T, which is a contaminant in zeolite L.

Second, a person of ordinary skill in the art would not expect the zeolites disclosed in Querini to have similar properties to zeolite L and to be regenerated by Querini's process. Mordenite and zeolite Y are only zeolites that Querini teaches. Mordenite and zeolite Y belong to different zeolite structure types, and zeolite L belongs to yet another different zeolite structure type, according to a widely known, standard reference book on zeolites titled the Atlas of Zeolite Structure Types, by W. M. Meier, D. H. Olson, and Ch. Baerlocher, published on behalf of the Structure Commission of the International Zeolite Association by Elsevier, Boston, Fourth Revised Edition, 1996 (hereinafter AZST; selected relevant pages attached). Mordenite is in the MOR structure type, zeolite Y is in the FAU structure type, and zeolite L is in the LTL structure type. See AZST, pp. 104, 132, and 152. The only other zeolite mentioned in either Querini or Wu is zeolite T, which is a structural intermediate of yet two other structure types, namely ERI and OFF. See AZST, pp. 100 and 166. A person of ordinary skill in the art would not expect such different zeolites to have similar catalytic properties or to be able to be regenerated by the same process.

Third, Querini teaches that zeolitic alkylation catalysts are not all the same and that some form more coke and are more stable than others, which suggests to a person of ordinary skill in the art that not all zeolites can be regenerated by the same process. Despite Querini's teachings

that mordenite and zeolite Y deactivate by the same mechanism, Querini does render it obvious to regenerate even mordenite zeolite by the process in Querini, since a person of ordinary skill in the art would recognize that merely because two catalysts deactivate by the same mechanism does not necessarily mean that they can be regenerated by the same process and since Querini does not test his regeneration process on mordenite zeolite. Querini tests his regeneration process on only lanthanum-exchanged zeolite Y catalysts. As for other zeolites, at most Querini in combination with Wu may render it obvious to try to regenerate another zeolite using the process of Querini, but "obvious to try" is not the proper standard under 35 U.S.C. 103.

Fourth, Querini's specific requirement of lanthanum-exchange for all Querini's zeolite Y catalysts and Wu's teachings about zeolite L being amenable to ion exchange would not motivate a person of ordinary to use zeolite L in the process of Querini. Wu teaches only that sodium and potassium can be exchanged for "other cations" and hydrogen, and in addition Wu is silent on lanthanum. In light of all the possible "other cations" associated with the elements of the Periodic Table, the teachings of Querini and Wu on ion exchange, alone or in combination, fail to provide any guidance to combine their teachings on zeolites and regeneration.

Fifth, a person of ordinary skill in the art, after having read Querini's teachings on catalyst regeneration would not be motivated to refer to Wu for teachings on catalyst regeneration, since Wu is silent on catalyst regeneration. Wu deals only with zeolite L crystallization.

Sixth, a person of ordinary skill in the art who has read Querini would find no motivation in Wu's statement about zeolite L being suitable to alkylation to choose the alkylation of isobutane with butenes from among all of the other possible alkylation reactions involving hydrocarbons. A person of ordinary skill in the art would recognize that a catalyst that is suitable for alkylating one hydrocarbon is not necessarily suitable for alkylating another hydrocarbon, especially since chemical catalysis is an inherently unpredictable art and since Wu's teachings provide a person of ordinary skill in the art no guidance in making a choice. At most, Querini in combination with Wu may render it obvious to try another zeolite in the alkylation of isobutane with butenes, but again "obvious to try" is not the proper standard under 35 U.S.C. 103. But even in that case, it would not be obvious to use Querini's process to regenerate that other zeolite, since a person of ordinary skill in the art would recognize that just because two catalysts

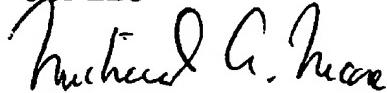
catalyze the same reaction does not necessarily mean that they can be regenerated by the same procedure.

For all of these reasons, Querini and Wu in combination do not render claim 1 obvious. Therefore, the rejection of claim 1 under 35 U.S.C. §103(a) as being unpatentable over Querini in view of Wu should be withdrawn. The rejection of claims 2 and 4-7 under 35 U.S.C. §103(a) as being unpatentable over Querini in view of Wu should be withdrawn for the reasons given in support of claim 1 because they are dependent on claim 1.

In view of the foregoing remarks, the subject application is now believed to be in a condition for an allowance of all claims and such action is respectfully requested.

Respectfully submitted,

UOP LLC



Michael A. Moore
Attorney for Applicant
Reg. No. 41,203

Attachments: Seven pages from Atlas of Zeolite Structure Types, by W. M. Meier, D. H. Olson, and Ch. Baerlocher, published on behalf of the Structure Commission of the International Zeolite Association by Elsevier, Boston, Fourth Revised Edition, 1996.